Testimony before the
Senate Science, Technology and Space Subcommittee
Senate Commerce, Science and Transportation Committee
by
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April 15, 1999

Introduction

Mr. Chairman, members of the Subcommittee, my name is Al Teich. I am the head of the Directorate for Science and Policy Programs at the American Association for the Advancement of Science (AAAS)[1]. I appreciate the opportunity to testify before you today.

Each year since 1976, AAAS has published a report analyzing research and development (R&D) in the proposed federal budget in order to make available to the scientific and engineering communities and to policymakers timely and objective information about the Administration's plans for the coming fiscal year. At the end of each congressional session, AAAS also publishes a follow-up report reviewing the impact of appropriations decisions on R&D, entitled *Congressional Action on Research and Development in the Budget*. Three years ago we established a Web site for R&D data on which we now post regular updates on budget proposals, appropriations, and outyear projections for R&D, as well numerous tables and charts. This year we are also posting the full text of our R&D reports on the site. The address for the site is www.aaas.org/spp/R&D.

My testimony today is designed to highlight trends in federal support for R&D over the past several years; to examine R&D in the Administration's budget proposal and, to the extent possible, in the congressional budget resolutions; and to review the outyear projections for R&D

[1] Founded in 1848, AAAS is the world's largest federation of scientific and engineering societies, as well as a professional organization with over 143,000 members and the publisher of *Science* magazine. The Directorate for Science and Policy Programs serves AAAS's objectives in six program areas where the interests of science, government, and society intersect: Science, Technology and Government; the Center for Science, Technology, and Congress; Research Competitiveness; Science and Human Rights; the Dialogue Between Science and Religion; and Scientific Freedom, Responsibility, and Law.

in both the Administration and congressional budgets.

Federal Investments in Research and Development

In the United States, unlike some nations, there is no overall, separately-identified budget for R&D and no special treatment of R&D in the federal budget. R&D programs are contained within the budgets of 25 federal agencies, in some cases representing a major share of the agency's budget and activities, in others, a relatively small portion of a much larger set of programs. The Office of Management and Budget (OMB), however, requires agencies whose annual R&D funding is greater than $10 million to submit data on their R&D programs as part of their annual budget submissions[2]. The agencies provide data on funding levels for basic research, applied research, development, R&D facilities, and R&D support to universities and colleges.

We use the OMB data as well as the agencies' congressional budget submissions as the source materials for our annual analysis. Because we cross-analyze the OMB and agency data and because this information is often updated and corrected after the budget is released in early February, our figures, including those on which I am basing this testimony, often differ from those in administration documents and in media reports.

Research and Development in the FY 2000 Budget Request

R&D Totals

In the FY 2000 request, federal R&D accounts for 14 percent of the proposed discretionary budget of $558 billion. The total discretionary request is well above the $537 billion cap on discretionary spending in FY 2000 (see Figure 1). In order to avoid exceeding the budget caps, the Administration has proposed offsets in the form of a new $0.55 per pack tax on cigarettes, and an accelerated phase-in of an existing tobacco tax increase. As you know, the cap on discretionary spending, which was part of the 1997 Balanced Budget Agreement, remains in force, even though the government ran a $70 billion surplus in FY 1998 and is projected to run surpluses in FY 1999 and 2000 as well. Adding to the pressure on domestic discretionary spending are demands from different constituencies to dedicate projected future surpluses to assuring the long-term solvency of Social Security and Medicare, to paying down the national debt, to strengthening the military, and to reducing taxes.

Because of these constraints on discretionary spending, many R&D programs are slated for cuts in the FY 2000 budget, and projections for future years are for continuing declines. The President's budget would provide $77.9 billion for the federal investment in R&D, about $1.4 billion (1.7 percent) less than the current FY 1999 estimate (see Table 1). With inflation expected to run at about 2 percent over the next year, the total federal R&D portfolio would lose nearly 4 percent in purchasing power. This downbeat outlook contrasts sharply with the overall increase of $3.4 billion

[2] Reported on OMB Circular A-11, Exhibit 44A, "Research and Development Activities."

(4.5 percent) that came out of last year's appropriations process.

One important marker in the FY 2000 proposal is the relation of civilian and defense R&D. For the first time since the late 1970s the total amount of civilian R&D in the budget would exceed that of defense R&D. The President had set this as a goal early in his first administration. It is important to remember that this goal has not been reached by somehow transferring money from one side of the budget to the other. Rather, defense R&D has been cut, while in the aggregate driven mainly by growth in the NIH budget, civilian R&D has been increasing. This trend would continue under the proposed FY 2000 budget, as civilian R&D would increase by $1.4 billion or 3.6 percent to $39.4 billion, while defense R&D would fall $2.7 billion (6.6 percent) to $38.5 billion. (See Table 1.) As a result, civilian R&D would constitute just over half (50.6 percent) of total R&D.

Trends in R&D by Budget Function

Among nondefense budget functions, general science, energy, transportation, agriculture, and commerce are priority areas for R&D in the administration's budget. Energy-related R&D in the Department of Energy (DOE) would receive a 15.3 percent increase to $1.4 billion because of additional funding for renewable energy technologies and energy conservation. General science R&D (which includes most areas of basic research apart from biomedical) would increase 5.6 percent to $5.7 billion because of increases in NSF and DOE, especially those programs involved in the multi-agency "Information Technology for the Twenty-First Century" (IT^2) initiative. Transportation R&D would increase 5.7 percent to $1.9 billion; and agriculture R&D would increase significantly 10.9 percent to $1.6 billion. Commerce R&D would increase by slightly more than 20 percent to $571 million because of increases for the Advanced Technology Program and the Advanced Measurement Laboratory at NIST. The FY 2000 budget request would increase investments in health and biomedical R&D only modestly, up 1.7 percent to $16.7 billion. Within the health budget function, the National Institutes of Health (NIH) would also receive a modest (by recent standards) increase of 2.1 percent for a *total* budget (including non-R&D items) of $15.9 billion. At $15.3 billion, NIH's R&D budget would, nonetheless, remain the largest among the civilian agencies.

Agency Highlights

Many of the agencies and programs under this Subcommittee's jurisdiction would see increases well above the rate of inflation in the Administration's budget request. R&D in the National Science Foundation (NSF) would increase 6.5 percent to almost $3 billion and the National Institute of Standards and Technology (NIST) would grow by nearly 21 percent. Using revenues from last year's Transportation Equity Act for the Twenty-First Century (TEA-21) the Department of Transportation's R&D activities would grow 38.7 percent to $836 million. However, other agencies would receive increases below the rate of inflation, for example, NASA would increase only 0.6 percent, and the National Oceanic and Atmospheric Administration (NOAA) would receive neither an increase or decrease and remain at FY 1999 funding levels (see Table 1).

Basic Research Trends

Basic research is a bright spot in the budget. Total support for basic research in FY 2000 would increase 4.7 percent to $18.1 billion under the President's proposed budget (see Table 2). Coming on the heels of a major increase in FY 1999 (due mostly to growth in the NIH budget) the

FY 2000 estimate represents growth of nearly 17 percent above FY 1998. In total dollars, NIH would continue to be the dominant supporter for basic research increasing to $8.6 billion. NSF support for basic research programs would grow 7.8 percent to $2.5 billion, almost 87 percent of its total R&D budget. NASA would receive the largest increase in basic research funding in FY 2000, growing 15.2 percent. This growth in NASA's basic research contrasts sharply with the quite modest overall increase in its R&D budget.

R&D in Colleges and Universities

Despite their comparatively small share of overall federal R&D funding, colleges and universities have longed played a key role in the nation's R&D effort. Academia serves as a primary site for the performance of basic research and the training of future scientists and engineers. Sixty percent of the R&D performed by colleges and universities is funded by the federal government, with most of the rest coming from the institutions' own funds. Despite substantial growth since the 1980s, universities still receive a relatively small proportion of their R&D support from industrial firms ($1.7 billion in FY 1997, about 7 percent of their total R&D). Total federal support of R&D at colleges and universities is expected to increase 2.3 percent to $15.5 billion in FY 2000, just slightly above the rate of inflation (see Table 3). Of that amount, 62 percent or $9.6 billion would come from the Department of Health and Human Services (mostly from NIH); NSF would contribute 15 percent or $2.3 billion; and DOD would provide 6.0 percent or $936 million. Other major supporters of academic R&D include NASA (5.9 percent or $914 million), DOE (4.4 percent or $685 million), and USDA (3.2 percent or $493 million).

Impact of FY 2000 Proposal on R&D Trends

To really understand what is happening to R&D in the budget, it is important to examine not just year-to-year changes, but longer-term trends as well. One useful reference point is the FY 1994 budget, since it was the last full budget year before the watershed election of 1994 and the major deficit reduction efforts that followed in its wake. Between FY 1994 and FY 1999, total federal R&D increased 2.3 percent in constant, inflation-adjusted dollars. Nondefense R&D rose 6.5 percent, while defense R&D fell 1.3 percent. Figure 2 illustrates the impact of the FY 2000 budget on these trends. If the proposals for FY 2000 are enacted, total R&D would show an overall decline relative to inflation. It would be down about 1.5 percent compared to our base year of FY 1994, the net of a further decline in defense R&D (down 9.7 percent altogether from FY 1994 to FY 2000) and 8.2 percent growth in nondefense R&D. Despite the fact that NIH would receive an increase barely sufficient to cover inflation under the Administration's proposal for FY 2000, it would still remain well ahead of the pack, with growth of more than 30 percent between FY 1994 and FY 2000. NSF, too, would be well above its FY 1994 level, up 15.8 percent in constant dollars over the past five years.

The President's Proposal Outlook to FY 2004

The AAAS analysis of outyear projections based on the budget request reveals that, despite the expectation of growing surpluses, the Administration is anticipating declines in both defense and

nondefense R&D after FY 2000. Under the President's plan most of the projected future surpluses would be dedicated to Medicare and Social Security, with relatively little left over for discretionary programs. Even among discretionary programs, R&D has been accorded lower priority this year relative to other areas, especially defense and education.

Federal support for R&D is projected to fall from $79.3 billion in FY 1999 to $78.5 billion in FY 2004, a decline of 10.7 percent after adjusting for expected inflation. Most of the decline is due to the reduction in defense R&D in FY 2000. By FY 2004, defense R&D would fall 14.3 percent in inflation-adjusted terms even as total defense spending would rise. Nondefense R&D would increase under the President's proposals from $38.1 billion in FY 1999 to $39.4 billion in FY 2004, but this gain becomes a 6.7 percent decline after adjusting for inflation.

These projections contrast with the outyear projections in the Administration's FY 1999 budget which included increases for nondefense R&D in future years. Under the FY 2000 plan, only a few programs would stay ahead of expected inflation. NASA's research (apart from aeronautics), DOE's fossil energy and energy conservation programs, the Department of Commerce's Advanced Technology Program (ATP), and DOT's highway and aviation R&D programs would receive real increases, while nearly all others would lose ground to inflation.

At the agency level, only DOT (up 34.9 percent after inflation), the Department of Education (up 11.2 percent), and the Department of the Interior (up 6.7 percent) would see their R&D increase between now and FY 2004. Other agencies would lose ground (see Figure 3), including NSF (down 3.4 percent after inflation), NIH (down 7.9 percent), DOE (down 3.5 percent), NASA (down 8.7 percent), and USDA (down 5.0 percent).

For defense R&D, the long post-Cold War slide in R&D funding would continue. DOD's priorities for the next few years include military personnel pay, operational readiness, and procurement of new weapons systems. While DOD's basic research (down 3.5 percent) and applied research (down 7.4 percent) programs would fare better than development, total DOD R&D would fall 15.1 percent after inflation to $35.7 billion in FY 2004.

The Congressional Budget Resolutions Outlook to FY 2004

Recently, the House and Senate approved separate budget resolutions setting congressional spending targets for FY 2000. Both chambers drafted similar plans calling for discretionary spending to be limited to $546 billion, approximately $9 billion above the budgetary cap (which is set to expire in FY 2003). Proposed offsets would come in the form of user fees, across-the-board reductions in federal costs, and the number of political appointees though specifics were not included. The draft plans reject the White House proposal to offset funding above the discretionary caps through tobacco-related mechanisms. Although there are few specifics in the budget resolutions regarding federal support of R&D, they do establish broad spending targets, and contain restrictive discretionary spending targets that could lead to declines in both defense and nondefense R&D in FY 2000 and future years.

The budget resolution divides discretionary spending into the existing broad budget functions, leaving the allocation of funds within these functions to the Appropriations Committees. Because of the lack of specificity in the resolutions, it is difficult to accurately assess their potential impacts on specific federal R&D programs. The AAAS analysis assumes that all programs within a particular function will be increased or cut in proportion to the overall increase or cut in the budget for that

function unless more specific information is provided in the committee reports accompanying the resolutions. Such an across-the-board allocation is, of course, unlikely, but it is probably the most reasonable assumption to make in the absence of other information.

Mirroring the outyear projections of the President's proposed budget, defense (5.6 percent) and education (15.6 percent) would be the only functions to receive increases through FY 2004 in constant dollars (see Table 4). Federal support for R&D, therefore, would be squeezed by tight discretionary caps and the higher priorities set for defense and education. Every agency except the Department of Education would see its R&D budget decline (see Figure 4), including NSF (14.0 percent), NIH (6.3 percent), DOE (13.5 percent), NASA (14.8 percent) and USDA (13.6 percent).

Looking just at the immediate future, the AAAS analysis of the budget resolutions indicates that total federal support for R&D would fall from $79.3 billion in FY 1999 to $75.9 billion in FY 2000. In the outyears, R&D would continue to lose ground to inflation. We estimate that R&D would total $76.1 billion in FY 2004, a decline of 13.5 percent in constant dollars relative to its FY 1999 level. By 2004, defense R&D would fall 14.3 percent in inflation-adjusted terms even as total defense spending would rise. Nondefense R&D also is projected to fall if the budget resolutions' assumptions are followed, from $38.1 billion in FY 1999 to $36.9 billion in FY 2004, a 12.5 percent decline after adjusting for inflation.

As noted, these projected cuts to nondefense R&D are generally steeper than the projected cuts elsewhere in the President's budget, because of a combination of lower total discretionary spending and higher defense and education spending.

Conclusion

The budget increases of the past two years have raised both hopes and expectations in the research community. Nevertheless, the caps on discretionary spending, the Administration's plans for using the surplus to shore up Social Security, the congressional leadership's desire to reduce taxes, and the general sense at both ends of Pennsylvania Avenue that defense and education are top priorities on the discretionary side of the budget, all suggest that R&D programs will face an uphill battle in FY 2000 and beyond.

Where are things likely to end up? The forecast for R&D can be summed up by a quote from Speaker of the House Dennis Hastert. In a recent interview he stated, "There's good news and bad news. The good news is that we have a surplus. The bad news is that we have a surplus. We have it [now] we've got to be responsible and do the right thing with it." The real problem facing policymakers in R&D and so many other realms is defining what that "right thing" is.

Mr. Chairman, that concludes my testimony.

AMERCIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Founded over 150 years ago, AAAS is the world's largest federation of scientific and engineering societies, with nearly 300 affiliates. AAAS counts more than 143,000 individual scientists, engineers, science educators, policymakers, and interested citizens among its members, making it the largest general scientific organization in the world. AAAS also publishes *Science* magazine, a prestigious and widely-quoted scientific journal as well as weekly newsmagazine of science. The continuing objectives of AAAS are to further the work of scientists, facilitate cooperation among them, foster scientific freedom and responsibility, improve the effectiveness of science in the promotion of human welfare, advance education in science, and increase the public understanding and appreciation of the importance of the methods of science in human progress.

ALBERT H. TEICH

Albert H. Teich has been Director of Science and Policy Programs at AAAS since 1990. Dr. Teich is responsible for the Association's activities in science and technology policy (including the AAAS R&D Budget and Policy Program, the Congressional Science and Engineering Fellows Program, the Center for Science, Technology, and Congress, and the Research Competitiveness Program) as well as programs in science and ethics, law, religion, and human rights. His directorate has a staff of 35 and a budget of approximately $4 million a year.

Prior to joining the AAAS staff in 1980, Dr. Teich held positions at George Washington University, the State University of New York, and Syracuse University.

Dr. Teich is author of numerous articles and editor of several books, including ***Technology and the Future***, a widely-used textbook on technology and society, the eighth edition of which will be published by Bedford/St. Martin's in late 1999, and ***Science and Technology in the USA***, volume 5 of Longman's "World Guides to Science and Technology," published in 1986.

Dr. Teich is a Fellow of AAAS, and a member of the editorial advisory boards to the journals, ***Science Communication; Science, Technology, and Human Values***; and ***Prometheus***. He has been a consultant to government agencies, national laboratories, industrial firms, and international organizations. He served as chairman of the advisory committee to the National Science Foundation's Division of Science Resources Studies from 1987 through 1990 and is currently a member of the Advisory Boards of the School of Public Policy at Georgia Tech, the School of Management and Technology of the University of Maryland's University College, and the Loka Institute, as well as the Policy Council of the Association of Public Policy Analysis and Management.

He holds a bachelor's degree in physics and a Ph.D. in political science, both from the Massachusetts Institute of Technology.